



US012208763B1

(12) **United States Patent**
Farooq et al.

(10) **Patent No.:** **US 12,208,763 B1**
(45) **Date of Patent:** **Jan. 28, 2025**

(54) **ARMREST MOUNTED DUAL CHAMBER AIRBAG**

- (71) Applicant: **Ford Global Technologies, LLC**, Dearborn, MI (US)
- (72) Inventors: **S. M. Iskander Farooq**, Novi, MI (US); **Mohammad Omar Faruque**, Ann Arbor, MI (US); **Dean M. Jaradi**, Macomb, MI (US)
- (73) Assignee: **Ford Global Technologies, LLC**, Dearborn, MI (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/360,154**
(22) Filed: **Jul. 27, 2023**

- (51) **Int. Cl.**
B60R 21/207 (2006.01)
B60R 21/233 (2006.01)
B60N 2/02 (2006.01)
B60N 2/75 (2018.01)
B60R 21/231 (2011.01)
B60R 21/261 (2011.01)

- (52) **U.S. Cl.**
CPC **B60R 21/207** (2013.01); **B60R 21/233** (2013.01); **B60N 2/02246** (2023.08); **B60N 2/767** (2018.02); **B60R 2021/23146** (2013.01); **B60R 2021/2612** (2013.01)

- (58) **Field of Classification Search**
CPC **B60R 21/207**; **B60R 21/233**; **B60R 2021/23146**; **B60R 2021/2612**; **B60N 2/767**; **B60N 2/02246**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,492,361 A *	2/1996	Kim	B60R 21/207
			280/730.2
5,730,458 A *	3/1998	Byon	B60N 2/79
			280/730.2
9,738,188 B2	8/2017	Honda et al.	
10,081,326 B2 *	9/2018	Koike	B60N 2/753
10,272,865 B2 *	4/2019	Nagasawa	B60R 21/18
10,569,732 B2 *	2/2020	Nagasawa	B60R 21/207
10,723,249 B2 *	7/2020	Dry	B60N 2/753
11,110,881 B1 *	9/2021	Deng	B60R 21/207
11,254,248 B1 *	2/2022	Line	B60N 2/767
11,273,785 B1	3/2022	Faruque et al.	
11,305,679 B2	4/2022	Lee et al.	
11,370,376 B2 *	6/2022	Deng	B60N 2/79
11,390,235 B2 *	7/2022	Kim	B60R 21/2338
11,541,840 B2 *	1/2023	Jaradi	B60R 21/264
11,603,068 B2 *	3/2023	Kawamura	B60R 21/207
11,608,020 B1 *	3/2023	Wheelwright	B60N 2/753
11,634,098 B1	4/2023	Line et al.	
11,851,020 B1 *	12/2023	Deng	B60R 21/23138

(Continued)

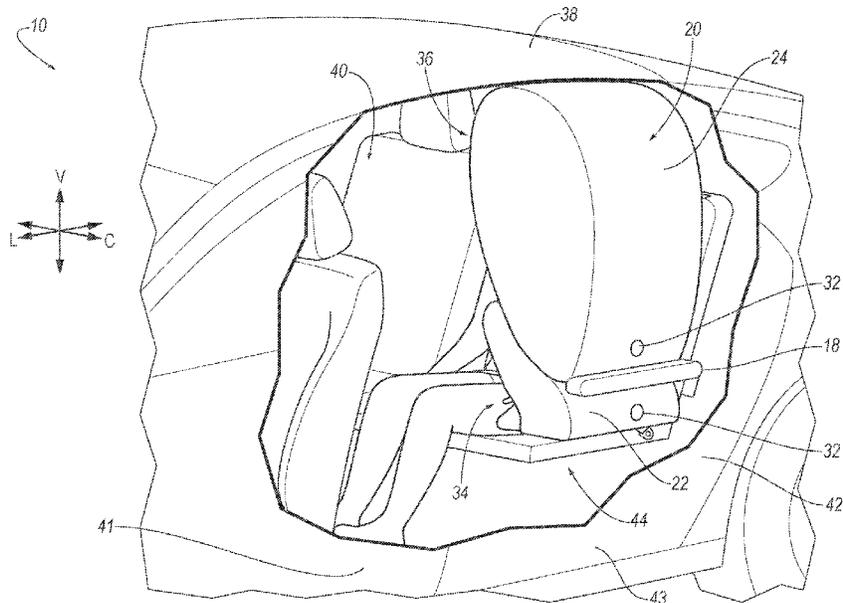
FOREIGN PATENT DOCUMENTS

AU 724195 B2 * 1/1998 B60R 21/20
Primary Examiner — Toan C To
(74) *Attorney, Agent, or Firm* — Frank A. Mackenzie;
Brooks Kushman P.C.

(57) **ABSTRACT**

A vehicle seat includes a seatback and an armrest coupled to the seatback. An airbag is positioned in the armrest and is inflatable from an uninflated position to an inflated position. The airbag includes a first chamber positioned to extend downward from the armrest and a second chamber positioned to extend upward from the armrest when the airbag is in the inflated position.

19 Claims, 5 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

2007/0052219 A1* 3/2007 Rust B60R 21/0428
280/751
2011/0278826 A1* 11/2011 Fukawatase B60R 21/231
280/730.2
2014/0151984 A1* 6/2014 Fukawatase B60R 21/23138
280/730.2
2017/0015271 A1* 1/2017 Paxton B60R 21/239
2017/0072893 A1* 3/2017 Fujiwara B60N 2/753
2018/0281724 A1* 10/2018 Nagasawa B60R 21/207
2018/0281725 A1 10/2018 Nagasawa
2019/0092264 A1 3/2019 Spahn et al.
2020/0317155 A1* 10/2020 Deng B60R 21/23138
2023/0062306 A1* 3/2023 Wheelwright B60R 21/207
2023/0091680 A1* 3/2023 Lee B60N 2/773
297/411.32
2023/0128759 A1* 4/2023 Deng B60R 21/2338
280/743.2

* cited by examiner

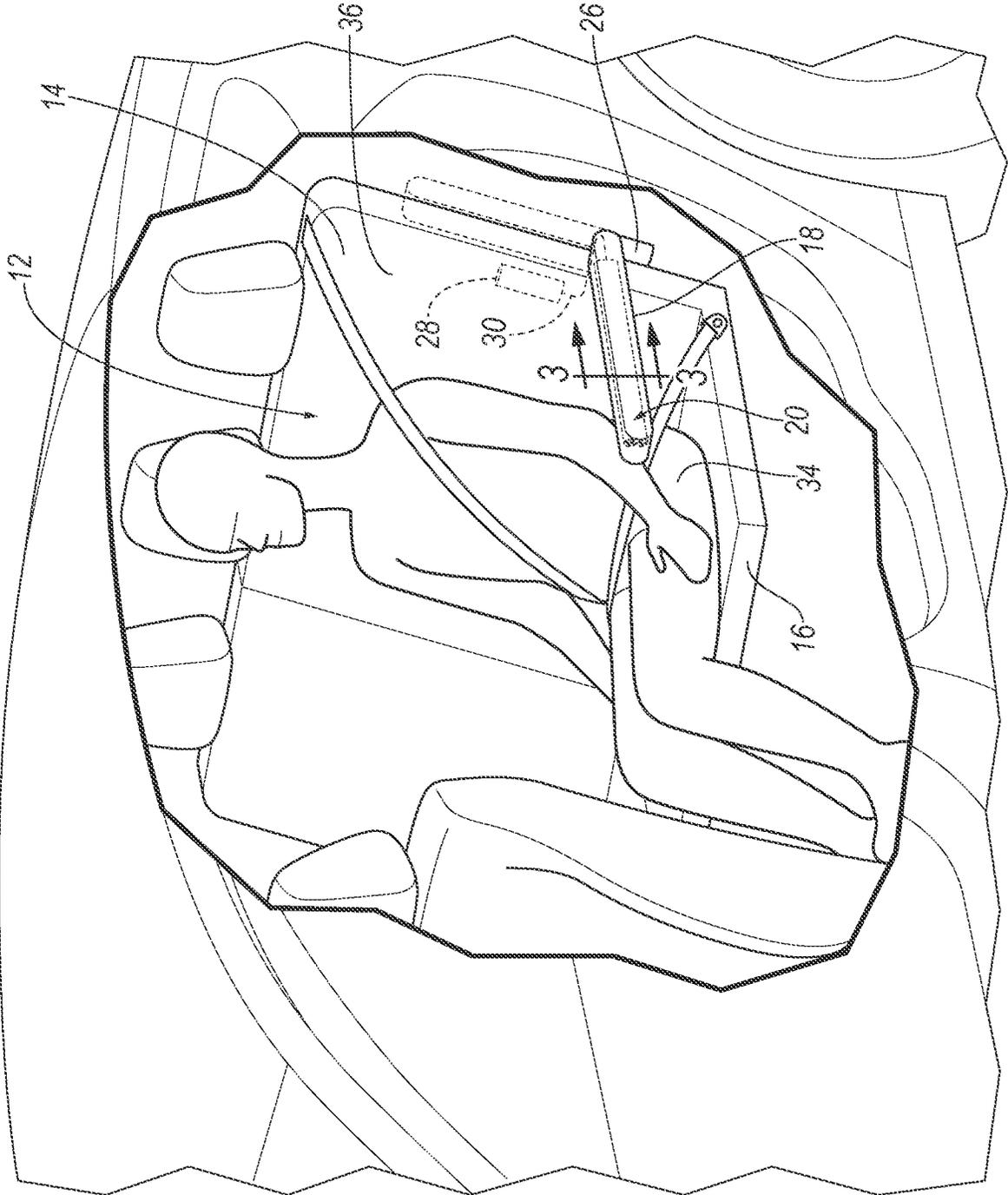


FIG. 1

10

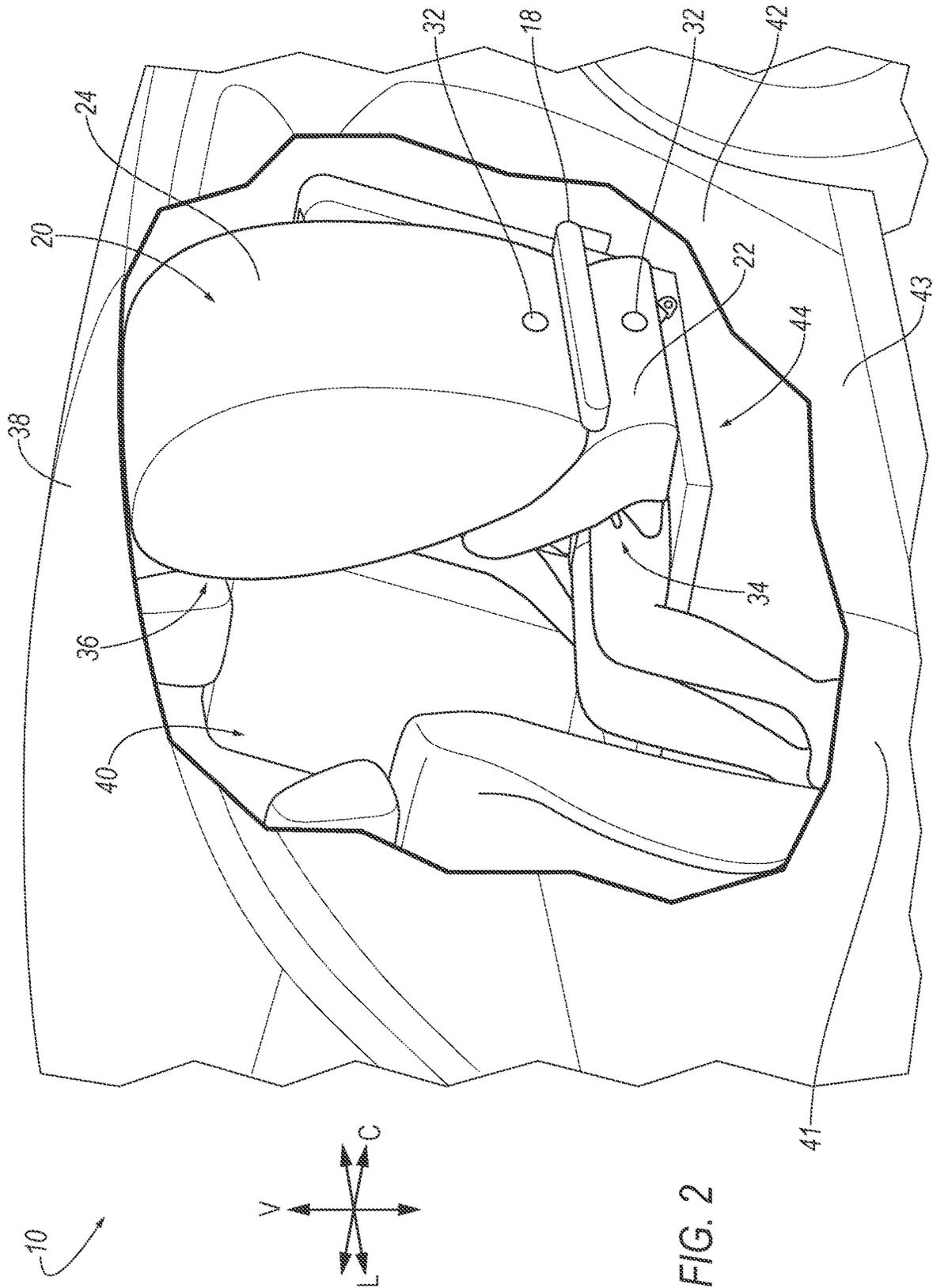


FIG. 2

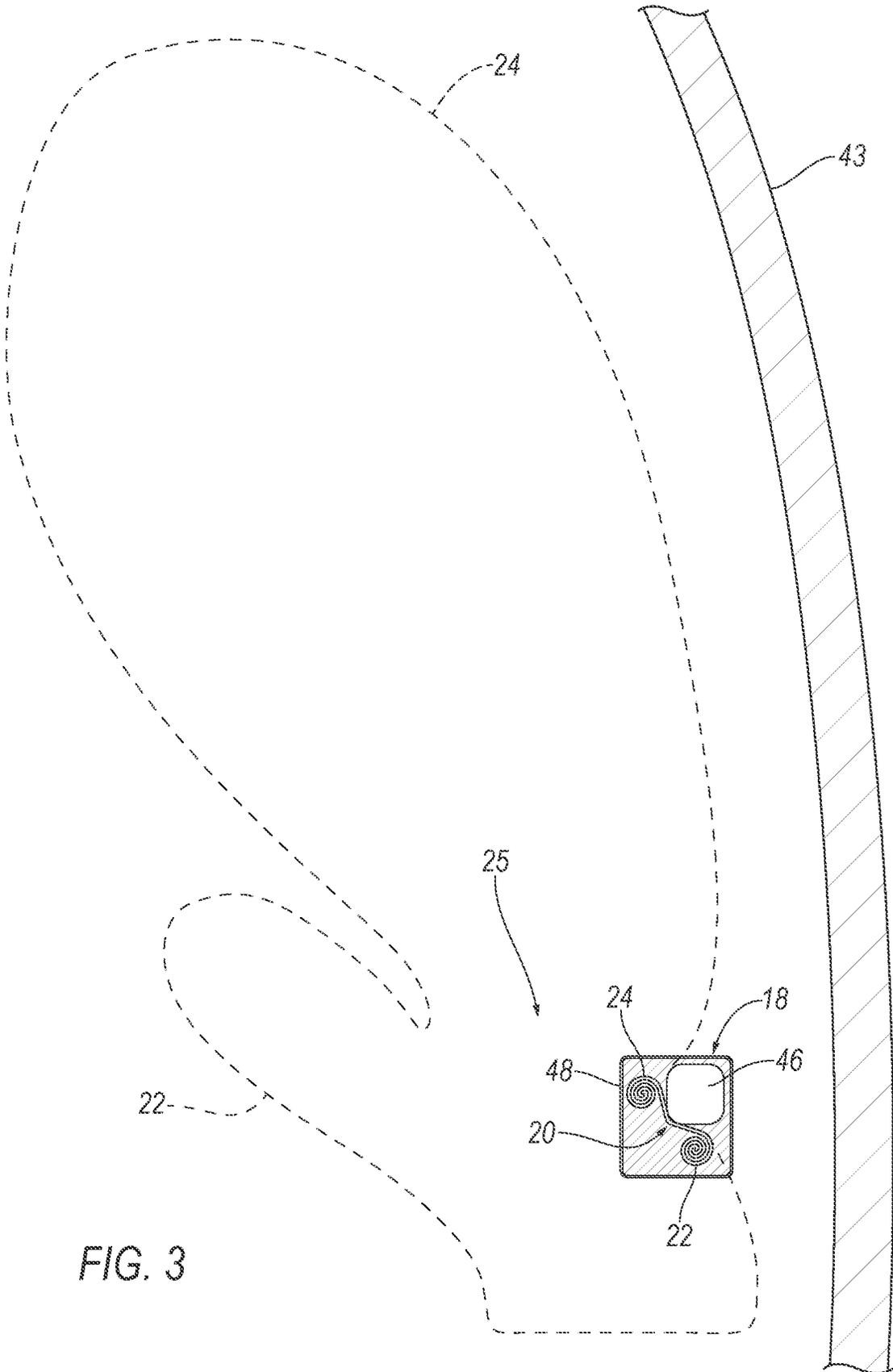


FIG. 3

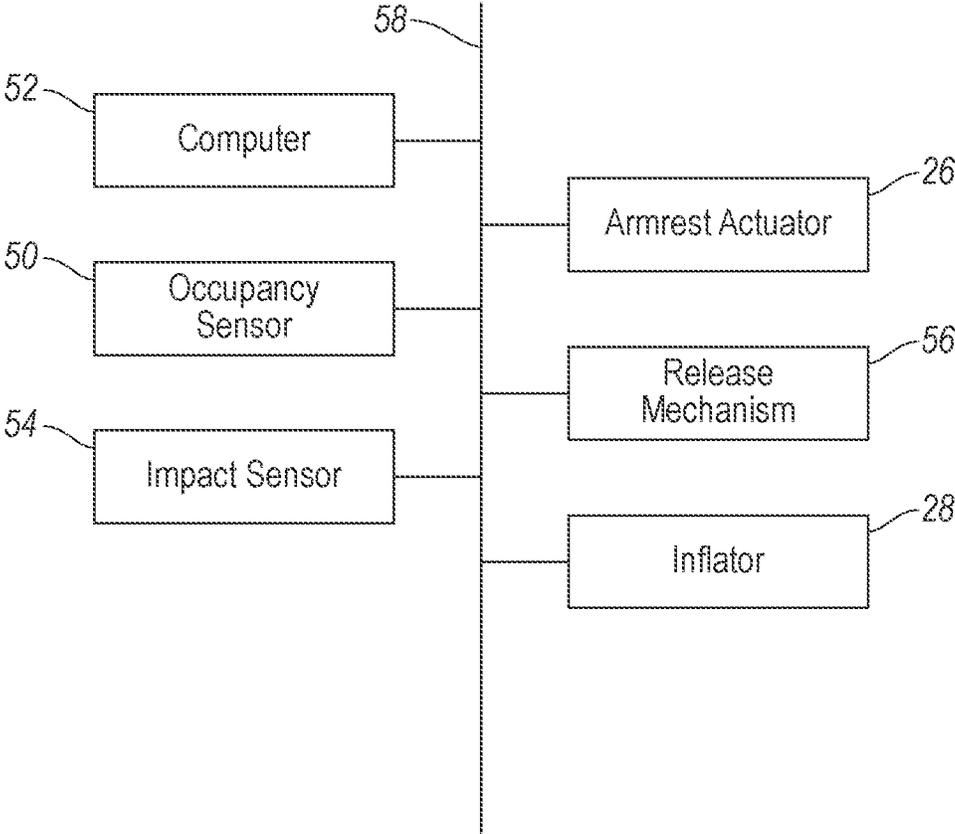


FIG. 4

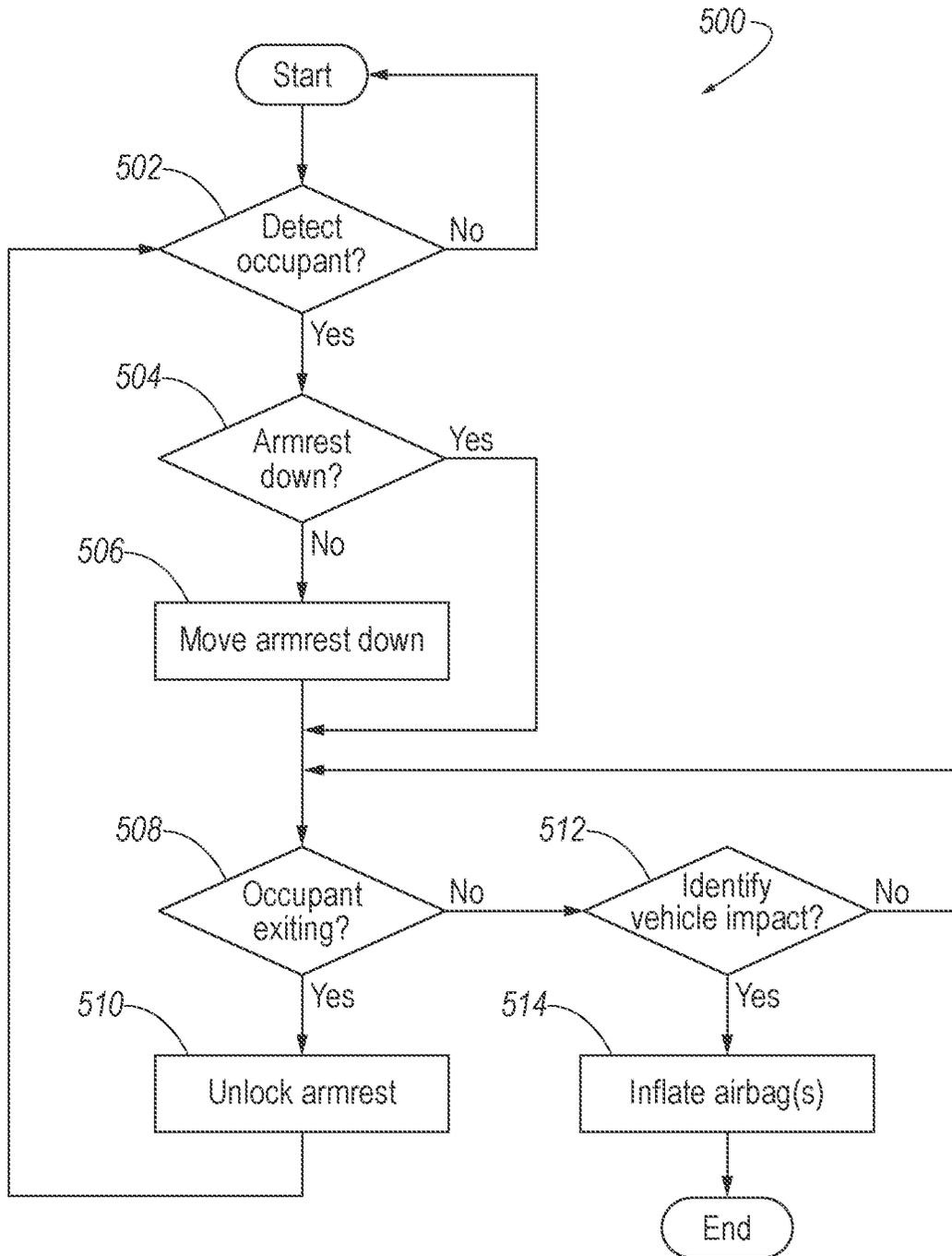


FIG. 5

1

ARMREST MOUNTED DUAL CHAMBER AIRBAG

BACKGROUND

Vehicles are equipped with airbag assemblies that include an airbag and an inflator. In the event of certain vehicle impacts, the inflator activates and provides inflation medium to the airbag. This pressurizes the airbag to control the kinematics of an occupant during certain vehicle impacts. The airbag assemblies may be located at various positions in the passenger compartment of the vehicle. Vehicles may include airbags supported on a dash, side air curtains mounted to roof rails, seat-mounted airbag, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a vehicle with a seat in a rear row having an armrest in a down position and an airbag in an uninflated position.

FIG. 2 is a perspective view of the vehicle with the airbag in an inflated position.

FIG. 3 is an end view in cross-section of the armrest and airbag.

FIG. 4 is a block diagram of a system of the vehicle.

FIG. 5 is a flowchart of a method executable by a vehicle computer.

DETAILED DESCRIPTION

A vehicle seat includes a seatback and an armrest coupled to the seatback. An airbag is positioned in the armrest and is inflatable from an uninflated position to an inflated position. The airbag includes a first chamber positioned to extend downward from the armrest and a second chamber positioned to extend upward from the armrest when the airbag is in the inflated position.

The armrest may be rotatably coupled to the seatback. The vehicle seat may include an actuator coupled to the armrest and operative to automatically move the armrest to a down position. The actuator may be a motor and a worm gear.

The first chamber and the second chamber may at least partially overlap with each other when in the inflated position. At least one of the first chamber and the second chamber may include at least one vent. The first chamber and the second chamber may be rolled in the uninflated position.

The vehicle seat may include an inflator fixed to the seatback and in fluid communication with the airbag. The vehicle seat may include a fill tube extending from the inflator to the airbag.

A vehicle seat includes a seat bottom defining an occupant leg area and a seatback supported by the seat bottom and defining an occupant torso area. An armrest is coupled to the seatback, and an airbag is positioned in the armrest and inflatable from an uninflated position to an inflated position. The airbag includes a first chamber positioned to extend downward from the armrest between the occupant leg area and the armrest and a second chamber positioned to extend upward from the armrest adjacent to the occupant torso area when the airbag is in the inflated position. The armrest may be rotatably coupled to the seatback and may include an actuator coupled to the armrest that is operative to automatically move the armrest to a down position. The actuator may be a motor and a worm gear. The vehicle seat may include an inflator in fluid communication with both the first cham-

2

ber and the second chamber that is operative to fill both the first chamber and the second chamber.

With reference to the Figures, wherein like numerals indicate like parts throughout the several views, a vehicle 10 includes a vehicle seat 12 having a seatback 14, a seat bottom 16, and an armrest 18 coupled to the seatback 14. An airbag 20 is positioned in the armrest 18 and is inflatable from an uninflated position (FIG. 1) to an inflated position (FIG. 2). The airbag 20 includes a first chamber 22 positioned to extend downward from the armrest 18 and a second chamber 24 positioned to extend upward from the armrest 18 when the airbag 20 is in the inflated position.

Having an airbag 20 with a first (e.g., lower) chamber 22 and a second (e.g., upper) chamber 24, allows airbag stiffness to be selectively adapted using vents 32 in the lower and upper chambers 22 and 24, respectively, to account for different stiffness needs of torso/thigh and head/neck/shoulder regions of the body. Having two chambers also allows the first chamber 22 and the second chamber 24 to partially overlap with each other when in the inflated position to help prevent contact with the armrest 18. The rolled airbag 20 packaged in the armrest 18 frees up space in the seatback 14 for other purposes.

The armrest 18 may be rotatably coupled to the seatback 14 and movable between an up or stowed position (shown in phantom) and a down or user position. The seat 12 may include an actuator 26 coupled to the armrest 18 that is operative to automatically move the armrest 18 to the down position. The actuator 26 may be a motor and a worm gear. When the presence of an occupant is detected, the actuator 26 is activated to move the armrest 18 to the down position if not already in the down position. The armrest 18 is locked in the down position by virtue of the worm gear arrangement. When it is determined that the occupant is exiting the vehicle, the armrest 18 is unlocked so that the armrest 18 can be manually moved to the up position to facilitate egress/ingress of the occupant.

With reference to FIG. 1, the vehicle seat 12 may include an inflator 28 fixed to the seatback 14 and in fluid communication with the airbag 20. The inflator 28 may be fixed to the seatback 14, e.g., the seatback frame, in any suitable way, e.g., threaded fastener, bracket, etc. The vehicle seat 12 may include a fill tube 30 extending from the inflator 28 to the airbag 20. The inflator 28 may be in fluid communication with both the first chamber 22 and the second chamber 24 and operative to fill both the first chamber 22 and the second chamber 24. In other words, one or more fill tubes can connect to the chambers to introduce gas to the first, second, or both chambers. The fill tube 30 may be coiled to allow for the up and down movement of the armrest 18.

In response to certain vehicle impacts the airbag 20 inflates relative to an occupant seating area of the vehicle seat 12. The occupant seating-area is the space occupied by an occupant properly seated on the seat. The occupant-seating area is vehicle-forward of the seatback 14 and above and vehicle-forward of the seat bottom 16. For example, the seat bottom 16 defines an occupant leg area 34 and the seatback 14 defines an occupant torso area 36. The inflator 28 expands the airbag 20 with inflation medium, such as a gas, to move the airbag 20 from the uninflated position to the inflated position. The inflator 28 may be, for example, a pyrotechnic inflator that ignites a chemical reaction to generate the inflation medium, a stored gas inflator that releases e.g., by a pyrotechnic valve stored gas as the inflation medium, or a hybrid.

In some examples, the seat 12 may include an armrest actuator 26 operatively coupled to the armrest 18 to move

the armrest **18** from the stowed position to the user position. The actuator **26** may be of any suitable type to move the armrest **18** from the stowed position to the user position and from the user position to the stowed position. As mentioned above, the actuator **26** may be a motor and a worm drive arrangement as is known in the art. For example, a worm wheel can be positioned on the armrest **18** and the motor can drive a worm screw meshed with the worm wheel. Worm drives are typically self-locking. In other words, the worm wheel cannot drive the worm gear. Accordingly, the armrest **18** can be locked in position (e.g., the down position) where the motor stops driving the worm gear. The worm drive arrangement can be unlocked to allow a user to move the armrest **18** between the up and down positions. For example, the worm wheel can be coupled to the armrest **18** with a releasable clutch mechanism. When the clutch mechanism is disengaged, the armrest **18** may be moved manually.

In order to facilitate proper deployment of the airbag **20**, the armrest **18** can be locked in the down position when a seated occupant is seated on the seat **12**. In this document, "seated occupant" refers to a properly seated occupant seated directly on the vehicle seat. The armrest **18** may be in the up position when no seated occupant is detected on the seat **12** (e.g., when no occupant is seated on the seat **12**, when an occupant is becoming seated on the seat **12**, when an occupant is exiting the seat **12**, and/or when a child restraint system (not shown) is identified on the seat **12** thus preventing possibility of an occupant properly seated directly on the seat). The armrest **18** may be in the up position to allow an occupant to become seated in the seat **12** or to allow an occupant to exit the seat **12**. The armrest **18** remains in the up position when a child restraint system is identified in the seat **12**. Specifically, the vehicle **10** may identify a child restraint system using an occupant classification system, sensors, cameras, weight sensors, a combination thereof, or any other suitable way of identifying the child restraint system. Described further below, an occupancy sensor **50** may identify the child restraint system.

With reference to FIG. 2, the first chamber **22** and the second chamber **24** may at least partially overlap with each other when in the inflated position. At least one of the first chamber **22** and the second chamber **24** may include at least one vent **32**. The vents **32** can be added to the upper and/or lower chambers of the airbag **20** to selectively control the stiffness/deflation characteristics for the occupant leg area **34** and the occupant torso area **36**. The first chamber **22** is positioned to extend downward from the armrest **18** between the occupant leg area **34** and the armrest **18** and the second chamber **24** is positioned to extend upward from the armrest **18** adjacent to the occupant torso area **36** when the airbag **20** is in the inflated position. Accordingly, the airbag **20** is positioned between rear door **43** and the occupant seating area, e.g., occupant leg area **34** and occupant torso area **36**.

The vehicle **10** may be any suitable type of automobile, e.g., a passenger or commercial automobile such as a sedan, a coupe, a truck, a sport utility, a crossover, a van, a minivan, a taxi, a bus, etc. The vehicle **10** includes a vehicle body. The vehicle body may be of a unibody construction, a body-on-frame construction, or any suitable construction. In the unibody construction, the vehicle body serves as a frame, and the vehicle body (includes the rockers, pillars, roof rails, etc.) is unitary, i.e., a continuous one-piece unit. As another example, in body-on-frame construction (also referred to as a cab-on-frame construction), the vehicle body and frame are separate components, i.e., are modular, and the vehicle body is supported on and affixed to the frame. In other examples, the vehicle body may have any suitable construc-

tion. The vehicle body may be of any suitable material, for example, steel, aluminum, etc.

The vehicle body includes a vehicle roof **38**, vehicle pillars, body panels, a vehicle floor, etc. The vehicle body defines a passenger compartment **40** to house occupants, if any, of the vehicle **10**. The passenger compartment **40** may extend across the vehicle **10**, i.e., from one side to the other side of the vehicle **10**. The passenger compartment **40** includes a front end and a rear end with the front end being in front of the rear end during forward movement of the vehicle **10**.

The vehicle **10** defines a vehicle-longitudinal axis L extending between a front end (not numbered) and a rear-end (not numbered) of the vehicle **10**. The vehicle **10** defines a cross-vehicle axis C extending cross-vehicle from one side to the other side of the vehicle **10**. The vehicle **10** defines a vertical axis V extending through a vehicle floor and the vehicle roof **38**. The vehicle-longitudinal axis L, the cross-vehicle axis C, and the vertical axis V are perpendicular relative to each other.

The vehicle roof **38** and the vehicle floor are spaced from each other. Specifically, the vehicle floor is spaced below the vehicle roof **38**. The vehicle roof **38** defines the upper boundary of the passenger compartment **40** and may extend from the front end of the passenger compartment **40** to the rear end of the passenger compartment **40**. The vehicle roof **38** may include roof rails and a roof panel extending from one roof rail to the other roof rail. The roof panel may be irremovably fixed to the roof rails. In other words, the roof panel is secured to the roof rails in such a way that removal requires destruction such as cutting, e.g., cutting material and/or welded joints, etc. As an example, the roof panel may be attached to both roof rails, e.g., by welding, fasteners, etc.

The vehicle floor defines the lower boundary of the passenger compartment **40** and may extend from the front end of the passenger compartment **40** to the rear end of the passenger compartment **40**. The vehicle floor may include upholstery, for example, carpet, and may have a class-A surface facing the passenger compartment **40**, i.e., a surface specifically manufactured to have a high quality, finished, aesthetic appearance free of blemishes.

The vehicle body includes a body side **42**. Specifically, the vehicle body includes two body sides **42** spaced cross vehicle **10** from each other. The body side **42** is a side of the body located vehicle-outboard of the passenger compartment **40**. The body sides **42** may be spaced from each other along the cross-vehicle axis C on opposite sides of the longitudinal axis L and may be elongated along the longitudinal axis L. The body side **42** includes one or more door openings. The vehicle floor extends from one body side **42** to the other body side **42** and the vehicle roof **38** extends from one body side **42** to the other body side **42**. The body side **42** may include a rear-window opening adjacent a seatback **14** of a rear one of the vehicle seats **12**.

The vehicle body, specifically each body side **42**, may include pillars. In some examples, the pillars on the same body side **42** are separated by one of the door openings. For example, the vehicle body may include a rear pillar on each side of the vehicle **10**. The rear pillar may extend between a liftgate and a rear door opening, and other pillars may be vehicle-forward of the rear pillars, e.g., between adjacent doors. The vehicle **10** may include any suitable number of pillars on either body side **42**. The pillars may extend from the vehicle roof **38** to the vehicle floor. The vehicle **10** includes vehicle doors **41** and **43**, openable for occupants to enter and exit the passenger compartment **40**. In the example shown in the Figures, the vehicle **10** includes a front door **41**

and a rear door **43** on each body side **42**. The front door **41** is vehicle-forward of the rear door **43** along the longitudinal axis L of the vehicle **10**.

The vehicle **10** may include one or more vehicle seats **12**. Specifically, the vehicle **10** may include any suitable number of vehicle seats **12**. The vehicle seats **12** are supported by the vehicle floor. The vehicle seats **12** may be arranged in any suitable arrangement in the passenger compartment **40**. One or more of the vehicle seats **12** may be at the front end of the passenger compartment **40**, e.g., a front row. One or more of the vehicle seats **12** may be behind the front end of the passenger compartment **40**, e.g., at the rear end of the passenger compartment **40** as a rear row **44**. In the example shown in the Figures, the vehicle **10** includes a rear row **44**. The rear row **44** in the Figures may be, in some examples, a second row or a third row. The vehicle seats **12** may be of any suitable type, e.g., a bucket seat, bench seat, etc.

As set forth above, the seat includes the seatback **14** and the seat bottom **16**. The vehicle seat **12** may include a head restraint at each occupant-seating area. The head restraint may be supported by and extends upwardly from the seatback **14**. The head restraint may be stationary or selectively adjustable relative to the seatback **14** by an occupant.

The seatback **14** may be supported by the seat bottom **16** and may be foldable relative to the seat bottom **16** and/or reclinable relative to the seat bottom **16** or may be stationary relative to the seat bottom **16**. The seatback **14** may extend from an upper end to a lower end. The lower end may be connected to the seat bottom **16**. The upper end of the seatback **14** may be spaced upwardly from the lower end of the seatback **14**, i.e., upwardly from the seat bottom **16**. The head restraint may extend upwardly from the upper end of the seatback **14**. The seatback **14**, the seat bottom **16**, and the head restraint may be adjustable in multiple degrees of freedom. Specifically, the seatback **14**, the seat bottom **16**, and the head restraint may themselves be adjustable. In other words, adjustable components within the seatback **14**, the seat bottom **16**, and the head restraint may be adjustable relative to each other.

The vehicle seat **12** includes a seat frame. The seat frame includes a seatback frame and a seat bottom frame, i.e., the seatback **14** includes the seatback frame and the seat bottom **16** includes the seat bottom frame. The seat frame may include panels and/or may include tubes, beams, etc. The seat frame may be of any suitable plastic material (e.g., carbon fiber reinforced plastic (CFRP), glass fiber-reinforced semi-finished thermoplastic composite (organosheet), etc.), a suitable metal (e.g., steel, aluminum, etc.), etc.

The vehicle seat **12** includes a covering supported on the seat frame. The covering may be cloth, leather, faux leather, or any other suitable material. The vehicle seat **12** may include padding material between the covering and the seat frame. The padding material may be foam or any other suitable material. The covering may be stitched in panels around the seat frame and padding material.

With reference to FIG. 3, the armrest **18** includes an armrest frame **46**. The airbag **20** is supported by the armrest frame **46**. Specifically, the airbag **20** is supported along a length of the frame **46**. In an example in which the airbag **20** includes a housing, the housing may be fixed directly to frame **46** of the armrest **18**. The airbag **20** is supported by the armrest **18** in the uninflated position and in the inflated position. In other words, the weight of the airbag **20** is borne by the armrest **18** in the uninflated position and the inflated

position. As an example, the first chamber **22** and the second chamber **24** may be rolled in the uninflated position as shown.

With continued reference to FIG. 3, when in the inflated position (shown in phantom), the airbag **20** contains a single volume with two chambers (i.e., first chamber **22** and second chamber **24**) in fluid communication with each other via a narrow region **25**. Narrow region **25** may be configured to selectively control the inflation/stiffness/deflation characteristics of the airbag chambers in addition to or in lieu of vents **32**.

The airbag **20** may be concealed by a covering **48**, e.g., the upholstery of the armrest **18**. In other words, the airbag **20** may be between the frame **46** of the armrest **18** and the upholstery of the armrest **18**. The covering **48** may include a tear seam (not numbered) associated with the airbag **20**. The airbag **20** may extend through the tear seam as it inflates from the uninflated position to the inflated position. The tear seam may be designed to tear apart when subjected to a tensile force above a threshold magnitude. In other words, the covering **48** on one side of the tear seam separates from the covering **48** on the other side of the tear seam when the force is above the threshold magnitude. The threshold magnitude may be chosen to be greater than forces from, e.g., inadvertent pushing against the seat by an occupant but be less than forces from the deployment of the airbag **20**. The tear seam may be, for example, a line of perforations through the covering **48**, a line of thinner covering material than the rest of the covering **48**, etc.

Although, examples are described with respect to armrests on the outboard side of a seat, armrest mounted airbags can also be applied to inboard armrests. Also, the disclosed armrest mounted airbags are applicable to captain's chairs as well as bench seats with armrests.

The airbag **20** may be of any suitable airbag material, e.g., from a woven polymer. For example, the airbag **20** may be formed of woven nylon yarn, e.g., nylon 6. Other suitable examples include polyether ether ketone (PEEK), polyetherketoneketone (PEKK), polyester, or any other suitable polymer. The woven polymer may include a coating such as silicone, neoprene, urethane, polyorganosiloxane, etc. The airbag **20** may be a single continuous unit, e.g., a single piece of fabric. Alternatively, the airbag **20** may include a plurality of segments, i.e., two or more. The segments may be attached to each other in any suitable fashion, e.g., a plurality of panels attached by stitching, ultrasonic welding, etc.

With reference to FIG. 4, the vehicle **10** may include at least one occupancy sensor **50**. Specifically, the occupancy sensor **50** may be coupled to the seat **12** to identify whether a seated occupant is seated in the occupant seating area. The occupancy sensor **50** may be or be a part of an occupant classification system that classifies the seated occupant that is seated in the seat **12**. For example, the occupancy sensors **50** may determine the size of the seated occupant. The occupancy sensor **50** may determine whether the seat **12** is occupied by a child restraint system. The occupant sensors may include cameras, weight sensors, etc. that determine and classify occupants of the seats **12**. The size of the occupant may be defined as the height, weight, or other relevant physical characteristics of the occupant that may be included in size measurements. The occupancy sensor **50** may be in communication with the vehicle computer **52**.

The vehicle **10** may include at least one impact sensor **54** for sensing certain vehicle impacts (e.g., impacts of a certain magnitude, direction, etc.), and a vehicle computer **52** in communication with the impact sensor **54**, occupancy sensor

50, armrest actuator 26, release mechanism 56, and the inflator 28. The vehicle computer 52 may activate the inflator 28, e.g., provide an impulse to a pyrotechnic charge of the inflator 28, when the impact sensor 54 senses certain vehicle impacts. Alternatively or additionally to sensing certain vehicle impacts, the impact sensor 54 may be configured to sense certain vehicle impacts prior to impact, i.e., pre-impact sensing. The impact sensor 54 is configured to detect certain vehicle impacts. In other words, a “certain vehicle impact” is an impact of the type and/or magnitude for which inflation of the airbag 20 is designed i.e., “certain” indicates the type and/or magnitude of the impact. The type and/or magnitude of such “certain vehicle impacts” may be pre-stored in the computer 52, e.g., a restraints control module and/or a body control module. The impact sensor 54 may be of any suitable type, for example, post contact sensors such as accelerometers, pressure sensors, and contact switches; and pre-impact sensors such as radar, LIDAR, and vision sensing systems. The vision sensing systems may include one or more cameras, CCD image sensors, CMOS image sensors, etc. The impact sensor 54 may be located at numerous points in or on the vehicle 10.

With continued reference to FIG. 4, the vehicle computer 52 includes a processor and a memory storing instructions executable by the processor. The memory includes one or more forms of non-transitory computer readable media, and stores instructions executable by the vehicle computer 52 for performing various operations, including as disclosed herein. The vehicle computer 52 may be a restraints control module. The vehicle computer 52 can be a generic computer with the processor and the memory as described above and/or may include an electronic control unit ECU or controller for a specific function or set of functions, and/or a dedicated electronic circuit including an ASIC (application specific integrated circuit) that is manufactured for a particular operation, e.g., an ASIC for processing sensor data and/or communicating the sensor data. In another example, the vehicle computer 52 may include an FPGA (Field-Programmable Gate Array) which is an integrated circuit manufactured to be configurable by a user. Typically, a hardware description language such as VHDL (Very High-Speed Integrated Circuit Hardware Description Language) is used in electronic design automation to describe digital and mixed-signal systems such as FPGA and ASIC. For example, an ASIC is manufactured based on VHDL programming provided pre-manufacturing, whereas logical components inside an FPGA may be configured based on VHDL programming, e.g., stored in a memory electrically connected to the FPGA circuit. In some examples, a combination of processor(s), ASIC(s), and/or FPGA circuits may be included in the vehicle computer 52.

The vehicle computer 52 is generally arranged for communications on a vehicle communication network 58 that can include a bus in the vehicle 10 such as a controller area network CAN or the like, and/or other wired and/or wireless mechanisms. Alternatively or additionally, in cases where the vehicle computer 52 actually comprises a plurality of devices, the vehicle communication network 58 may be used for communications between devices represented as the vehicle computer 52 in this disclosure. Further, as mentioned below, various controllers and/or sensors may provide data to the vehicle computer 52 via the vehicle communication network 58.

With reference to FIG. 5, the vehicle computer 52 stores instructions to control components of the vehicle 10 according to a method 500. Specifically, the method 500 includes moving the armrest 18 from the up position to the down

position and, where applicable, unlocking the armrest 18. Any use of “based on” and “in response to” herein, including with reference to method 500, indicates a causal relationship, not merely a temporal relationship. Operations, systems, and methods described herein should always be implemented and/or performed in accordance with an applicable owner’s/user’s manual and/or safety guidelines.

With reference to decision block 502, the method 500 includes detecting occupancy of the seat 12 by a seated occupant. The occupancy sensor 50 may indicate to the vehicle computer 52 that a seated occupant is detected in the seat 12. If a seated occupant is detected, the method 500 moves to block 504. If no seated occupant is detected (e.g., the occupancy sensor 50 detects that no occupant is properly seated on the seat 12, the occupancy sensor 50 detects a child restraint system thus indicating that no occupant is in the seat 12, etc.), the method 500 returns to the start.

With reference to decision block 504, in response to detecting the seated occupant, the method 500 determines if the armrest 18 is in the down position. If the armrest 18 is determined to be in the down position, the method 500 moves to block 508. If the armrest 18 is not determined to be in the down position (e.g., the armrest is in the up position or somewhere in-between the up position and the down position), the method 500 moves to block 506. At block 506 the vehicle computer 52 may send a signal to the armrest actuator 26 to move the armrest 18 toward the down position. Moving the armrest 18 toward the down position may include engaging the worm drive by engaging the clutch on the worm wheel.

With respect to decision block 508, the method 500 includes determining whether the occupant is exiting the seat 12. In some examples, the occupant may indicate manually that the occupant is exiting the seat 12, e.g., by activating a button or switch supported by any suitable component of the vehicle 10, such as the seat 12 or an instrument panel. In other examples, sensors may indicate that the occupant is exiting the seat 12, e.g., by cameras, weight sensors, door sensors, etc. In response to determining the occupant is exiting the seat 12, the method 500 moves to block 510. If the occupant is not determined to be exiting the seat 12, the block moves to block 512.

At block 510, the method 500 includes unlocking the armrest 18 so that an occupant can manually move the armrest 18 from the down position to the up position. The vehicle computer 52 can activate the release mechanism 56 (e.g., disengage the clutch on the worm wheel) based on decision block 508. In other examples the armrest 18 can be unlocked manually by pushing a button on the armrest 18, for example. After the armrest 18 is unlocked, the method 500 returns to decision block 502 to identify whether an occupant is seated in the seat 12.

With respect to decision block 512, in response to determining the occupant is not exiting the vehicle 10, the method 500 includes identifying whether an impact has occurred to the vehicle 10. In the event of an impact, the impact sensors 54 communicate the occurrence of the impact to the computer 52. If an impact is identified, the method 500 moves to block 514. If no impact is identified, the method 500 returns to decision block 508 to determine whether the occupant is exiting the seat 12.

With respect to block 514, the method 500 includes inflating the airbag 20 to the inflated position. The inflator 28 passes inflation medium through the fill tubes 30 to inflate the airbag 20 to the inflated position. The method 500 ends after the inflation of the airbag 20.

The disclosure has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation. The numerical adverbs "first," "second," and "third" are used herein merely as identifiers and do not signify order or importance. Many modifications and variations of the present disclosure are possible in light of the above teachings, and the disclosure may be practiced otherwise than as specifically described.

What is claimed is:

- 1. A vehicle seat, comprising:
a seatback defining an occupant-seating area;
an armrest coupled to the seatback; and
an airbag positioned in the armrest and inflatable from an uninflated position to an inflated position on a lateral side of the occupant-seating area, the airbag including:
a first chamber positioned to extend downward from the armrest; and
a second chamber positioned to extend upward from the armrest when the airbag is in the inflated position.
- 2. The vehicle seat as set forth in claim 1, wherein the armrest is rotatably coupled to the seatback.
- 3. The vehicle seat as set forth in claim 2, further comprising an actuator coupled to the armrest and operative to automatically move the armrest to a down position.
- 4. The vehicle seat as set forth in claim 3, wherein the actuator comprises a motor and a worm gear.
- 5. The vehicle seat as set forth in claim 3, wherein the first chamber and the second chamber at least partially overlap each other when in the inflated position.
- 6. The vehicle seat as set forth in claim 1, wherein the first chamber and the second chamber at least partially overlap each other when in the inflated position.
- 7. The vehicle seat as set forth in claim 6, wherein at least one of the first chamber and the second chamber includes at least one vent.
- 8. The vehicle seat as set forth in claim 1, wherein the first chamber and the second chamber are rolled in the uninflated position.
- 9. The vehicle seat as set forth in claim 1, further comprising an inflator fixed to the seatback and in fluid communication with the airbag.

10. The vehicle seat as set forth in claim 9, further comprising a fill tube extending from the inflator to the airbag.

- 11. A vehicle seat, comprising:
a seat bottom defining an occupant leg area;
a seatback supported by the seat bottom and defining an occupant torso area;
an armrest coupled to the seatback; and
an airbag positioned in the armrest and inflatable from an uninflated position to an inflated position on a lateral side of the occupant torso area, the airbag including:
a first chamber positioned to extend downward from the armrest between the occupant leg area and the armrest; and
a second chamber positioned to extend upward from the armrest adjacent to the occupant torso area when the airbag is in the inflated position.
- 12. The vehicle seat as set forth in claim 11, wherein the armrest is rotatably coupled to the seatback and further comprising an actuator coupled to the armrest and operative to automatically move the armrest to a down position.
- 13. The vehicle seat as set forth in claim 12, wherein the actuator comprises a motor and a worm gear.
- 14. The vehicle seat as set forth in claim 11, wherein the first chamber and the second chamber are rolled in the uninflated position.
- 15. The vehicle seat as set forth in claim 11, wherein the first chamber and the second chamber at least partially overlap each other when in the inflated position.
- 16. The vehicle seat as set forth in claim 11, wherein at least one of the first chamber and the second chamber includes at least one vent.
- 17. The vehicle seat as set forth in claim 11, further comprising an inflator fixed to the seatback and in fluid communication with the airbag.
- 18. The vehicle seat as set forth in claim 17, further comprising a fill tube extending from the inflator to the airbag.
- 19. The vehicle seat as set forth in claim 11, further comprising an inflator in fluid communication with both the first chamber and the second chamber and operative to fill both the first chamber and the second chamber.

* * * * *